SUBSTITUTE SPECIFICATION

PACKAGING METHOD AND APPARATUS

This application is the national phase under 35 U.S.C. §371 of PCT International Application No. PCT/IL00/00114 which has an International filing date of February 23, 2000, which designated the United States of America and was published in English.

FIELD OF THE INVENTION

The present invention concerns generally to a method and apparatus for packaging a product in a hennetically sealed container. The method and apparatus of the invention are particularly applicable to the packaging of food products, medical supplies or devices, although not limited to these applications.

BACKGROUND OF THE INVENTION

Very often a product contained within a container does not fill the entire container's space with the remaining space (to be referred to herein as the "residual space") containing a gas. Often, the gas's composition plays a role in the product's shelf life. This is the case, for example, in containers holding food products. Air, which contains about 21% oxygen, facilitates growth and development of microorganisms that degrade the food product. There are many apparatuses and method which have been proposed and developed aimed at replacing the air in the residual space with another gas having a desired composition. For example, in the case of food products such a replacement gas is typically nitrogen or carbon dioxide.

In the context of this writing the gas which is introduced into the container to fill the residual space will be referred to herein as the "replacement gas". As will no doubt be appreciated, the nature of the replacement gas depends on the type of product and the type of desired effect. In the case of food products, a replacement gas will be a gas which has a composition such that it does not permit growth and development of microorganisms, particularly a gas essentially devoid of oxygen. In the case of other kinds of products the replacement gas may have a variety of different gas composition, for example: consisting of a chemically inert, e.g. a noble gas; consisting of a gas with a certain surface activity to treat or prepare the product; may be a disinfecting gas intending to destroy microorganisms which may be contained in or on the product; etc.

GENERAL DESCRIPTION OF THE INVENTION

The present invention is directed to a method and system for packaging a product within a container such that the residual space is substantially filled with a replacement gas. The type of container to which the invention pertains is such made from a rigid or semi-rigid body having side walls with rims defining a product-introducing opening. The container body may have a base with side walls extending therefrom; it may be conical; it may be hemispheric. Such a body of a container will be referred to herein as "cup-like shaped body". The cup-like shaped body may have a generally rectangular base, a circular or oval base, may be elongated or flat (having a dish-like shape), may be a container formed With a partition for separate storage of two different components in two individually sealed compartments, e.g. granola in one compartment and yogurt in the other; and a variety of different shapes. It may readily be appreciated

that the invention is not limited to containers of a different shape and any container having a cup-like shaped body. as defined herein, may be filled by the use of the apparatus and method of the invention.

The term "rigid" or "semi-rigid" refers to the ability of the container self-sustaining its shape. An example of a container body with these properties is such made of tin, or preferably a container body made of a rigid plastic material of the kind typically used for a variety of food products such as dairy products. A rigid or semi-rigid body may also be a body made of a flexible material reinforced by ribs, by fold lines formed by welding, or by a variety of other reinforcing means known per se, imparting a shape-retaining property onto said body.

The present invention provides, by a first of its aspects, a method for packaging a product in a hennetically sealed container having a cup-shaped rigid or semi-rigid body with a rim fitted with a closure, the method comprising:

(a) introducing the product into said cup-like shaped body;

(b) forming an isolated space with a gas inlet and a gas outlet. the space defined between said body and a closure-forming member adjacent to and with a clearance from said rim;

(c) introducing a replacement gas through said inlet to replace at least a substantial portion of gas originally contained in said isolated space: and

(d) displacing at least one of said body or said closure-forming member towards the other of the two members to close said clearance and to attach the closure-forming member to said rim, and hermetically attaching the two to one another to form a gas-tight steel.

As will be appreciated, steps (a) and (b) may be performed one after the other in the given order; may be in their reversed order, namely first forming the isolated space and then introducing the product is introduced into the container within such space: or the two steps may be carried out simultaneously.

By its second aspect, the present invention provides an apparatus for forming a hermetically sealed product-containing container. the container having an essentially cup-like shaped body with rims fitted with a closure: the product not filling the entire container leaving residual space therein; the apparatus comprising:

- a holder for holding said container body;
- a spacer member sealingly engageable with said holder and with a closure-forming member, and having an opening; in a state of seal engagement of said spacer member with said holder and said closure-forming member, said opening, said container body and said closure-forming member, define together the isolated space:
- a gas inlet and a gas outlet for introducing a replacement gas into said isolated space. and exhausting gas therefrom. respectively; and
- a sealing mechanism comprising a displacing arrangement for displacing one or both of said container body and said closure-forming member towards one another and attaching them to one another in a gas-tight fashion.

The closure of the container may in principle be any closure which can be made to form a hennetically sealed attachment with the container body. In the case of a container body made of a plastic material, the closure-forming member is preferably

heat weldable, for heat welding to the body's rim. Such a film is preferably a laminate as generally known in the art, for example a laminate of two plastic films, a laminate of a plastic film and aluminum foil, a laminate consisting of more than two layers, and many others, all as known per se. It should however be appreciated that although a closure-forming member made of a film is but one embodiment and other embodiments, such as a closure forming member made from a rigid or semi-rigid plastic material may also be employed.

Where said closure-forming member is a film, in order to close said clearance, at least a portion of the film will typically be pushed towards the rim of the container's body and then heat welded thereto, followed by trimming the film around the rim.

In accordance with one, currently preferred, embodiment of the invention, the gas outlet is connected to the external atmosphere. In accordance with another embodiment, the gas outlet is connected to a vacuum source. Where a vacuum source is employed, typically but not exclusively, the vacuum is first applied, gas is drained from within said isolated space. and only after a period of time allowing for gas drainage, the replacement gas is introduced.

In accordance with the above preferred embodiment, said holder is a planar member formed with an opening for receiving and engaging the container body. The holder is typically provided with a skirt surrounding the opening for holding and engaging the rims of said container body.

The gas outlet may be formed by bores in said holders, preferably bores leading from a portion adjacent said opening therein to the outside atmosphere. Alternatively, the gas outlet may also be constituted by bores within said spacer member.

Tile gas inlet is typically formed within said spacer member. The gas inlet preferably comprising a plurality of nozzles. Where the gas outlet is formed in said spacer member, such nozzles will usually be formed in portions of the spacer member other than portions hosting the gas outlet bores. The nozzles will usually be directed into the isolated space so as to ensure sufficient turbulence for effective flushing of the residual space with the replacement gas.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, preferred embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is an exploded view of an apparatus in accordance with a preferred embodiment of the invention.

Fig. 2 is an isometric view of the apparatus of Fig. 1.

Figs. 3A-4A shows the apparatus of Fig. 1 in several operational steps, where Figs. 3A-3E are partially cut, isometric views, and Figs. 4A-4F are partial and cross-sectional longitudinal views of the apparatus in corresponding operational steps.

Fig. 5 is an exploded view of an apparatus in accordance with another embodiment of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is first being made to Figs. 1 and 2 showing an apparatus in accordance. with an embodiment of the invention. Fig. 1 shows the apparatus generally designated **100**, in an exploded view. Fig. 2 shows an apparatus as a workstation in a

packing line generally designated **102**. The apparatus **100** comprises, as can best be seen in Fig. 1, a holder **104** for holding a rigid or semi-rigid cup-shape container body **106**, received within opening **108** fitted with an upright skirt **110**. Holder **104** is held in accordance with one embodiment of the invention, on a revolving feeding carousel **120** seen in Fig. 2.

Three holders are seen in Fig. 2, the first designated **104'**, accommodating a container filled with a pasty substance **122** prior to its introduction to apparatus **100**; the second holder designated **104"** being situated and forming a function as a part of a workstation **100'**; the third holder designated **104""** accommodating a sealed container exiting from workstation **100'** and sealed with a closure **124**. It is thus apparent that carousel **120** isolates in the direction of arrow **126**.

As will be appreciated, although the invention will be described herein with particular reference to the application for packaging a pasty-food product, particularly a dairy product, it is clear that the invention is not limited thereto and it applies, *mutatis mutandis*, to packaging of a variety of other food products, as also defined above.

Holder **104** is formed with gas outlet bores **112**.

Apparatus **100** further comprises a spacer member **130** formed with a central opening **132**, there being a plurality of gas inlet nozzles **134** pointing towards the opening's interior. Gas nozzles **134** are in flow communication with replacement gas inlet pipe **136**, connected to a source of replacement gas (not shown). In the case of a food product, the replacement gas is typically nitrogen or carbon dioxide.

The apparatus further comprises a sealing and trimming mechanism **150** comprising a film pressing plate **154**; displacement limiting members **156** fitted over

axial rods **157**, limiting upwards displacement of plate **154**; a film displacement and heat welding plate **160** having two bores **162** engaged with the end **168** of a spring biased piston rod of a piston **164** held by plate **166**. Plate **166** is engaged at its bore **170** to the end of a piston rod of pneumatic or hydraulic piston **176** and is axially displaceable thereby. The apparatus further has a trimming member **180**.

Two pneumatic or hydraulic pistons member **182** and **184** with piston rods **186** and **188**, respectively are provided, and are connected, through respective bores **190** and **192** to pressing plate **154**.

As can best be seen in Fig. 2, the apparatus is fed with a continuous film **200** constituting a closure-forming member, which extends between spacer member **130** and film pressing plate **154**. In a manner to be described further below, the used film exiting the apparatus and fed to a pickup spool (not shown) has cutouts **202** resulting from cutting out a portion used for closure of the container.

The operation of the apparatus will now be described with reference to Figs. 3A-4F.

A first step of operation can be seen in Figs. 3A and 4A. Container body **106**, having in this specific embodiment inverted frustoconical shape, is received within holder **104** with the container's rim **107** resting over skirt **110**. A film sheet **200** is tensioned between the spacer member **130** and film pressing plate **154** with sealing and trimming mechanism **150** being in a state such that heat welding plate **160** is distanced from the film. Film pressing plate **154** is displaced axially in its downward direction by means of the pneumatic or hydraulic pistons **182** and **184**, extracting and retracting the

respective piston rods **186** and **188** and which are articulated at bores **190** and **192**, respectively to the film pressing plate **154**.

At a next stage seen in Figs. 3B and 4B, the holder **104** and the remaining part of apparatus **100** are mutually displaced (either by elevating holder **104** or by lowering the reigning parts of the apparatus) so as to bring to engagement of spacer member **130** with peripheral portion **109** (Fig. 4A), with an O-ring **111** fitted within a groove at a bottom face of spacer member **130**, ensuring that the attachment will be in a gas-tight manner (not permitting gas passage through interface between these two bodies.

In a next step shown in Figs. 3C and 4C, pressing plate **154** is lowered by means of piston rods **186** and **188**, whereby the film is pressed between juxtaposed faces of film pressing plate **154** and upper face of spacer member **130**. The O-ring **190** received within groove in the upper face of spacer member **130**, ensures a gas-tight seal between film **200** and the spacer member. In this manner, a confined space **204** is defined between the container body **106**, the film **200** and inwardly facing wall surfaces of holder plate **104** and spacer member **130**.

Container body **106** contains a pasty food product, e.g. a dairy product **122** filled up to a certain level and leaving a residual space **210** between the upper face of the pasty food product **122** and the container's rim **107**.

In the next step, seen in Fig. 4D, a replacement gas is introduced through nozzles **134** to generate a turbulent flow represented schematically by solid, curved arrowed lines **216**, resulting in flushing of the residual space with the replacement gas. At the same time, gas is evacuated to the external atmosphere through bores **112**, as represented schematically by dashed curved arrowed lines **218**. In this specific

embodiment the nozzles are at a level which is below that of the rim **107** of the container. This is in order to avoid direct blow of air jets on the food product which can cause the formation of an aerosol which is undesired. It should however be appreciated that this position of the nozzle is but an example and in other embodiments there may be other positions of the nozzles including such above the rim's level.

A subsequent step can be seen in Figs. 3D and 4E in which a sub-assembly consisting; of plate **166**, welding plate **160** and trimming member **180** is lowered towards the film **200**, pushing the film **200** downwards to tightly engage rim **107** while the heat generated by plate **160** caused the film to weld to the rim. Welding plate **160** is downwardly biased by means of coiled-spring pistons **164** and thus the lower face, of the plate **160** is at a lower level than the cutting edge **181** of trimming member **180**. This axial displacement of the sub-assembly is achieved by means of a piston rod **177** extending out of piston **176**.

At a next step, seen in Figs. 3E and 4F this sub-assembly continues its downward movement, represented by arrows **226** in Fig. 4F, causing compression of the spring within piston **164** and, thus bringing to an additional downward pressure for better sealing of film **200** onto rim **107**. This downward displacement brings to lowering of a trimming edge **181** of trimming member **180** so as to trim film **200**. Thereby, a container **122**, where the residual space **210** is filled with the replacement gas, is formed.

Reference is now being made to Fig. 5 showing another embodiment in accordance with the invention. The apparatus **300** in accordance with this embodiment is identical at most of its components to the embodiment of Fig. 1 and only the

differences will be outlined hereinbelow. Hereinbelow, when reference will be made to like components, they will be designated by the same reference numeral as used in the embodiment described above, shifted by **200**.

Spacer member **330** is provided with a replacement gas inlet **336** and a gas outlet **600** leading to a vacuum source (not shown). Gas inlets and gas outlets are connected to corresponding nozzles **334** (only one set seen in this figure).

Another difference resides in the provision of a vacuum-forming cup **604** connected through tube **606** to the vacuum source. The vacuum-forming cup **604** is axially displaceable by means of piston **610** and is adapted for sealing engagement with a bottom surface of holder **304**, by means of O-ring **612**.

Bores **312** lead into the interior of vacuum-forming cup **604**.

In operation, a vacuum forming cup is attached to the bottom of holder **304** and the vacuum source is connected leading to the formation of a vacuum within the confined space. In addition, the vacuum within the interior of vacuum-forming cup **604** ensures that the container body **306** does not collapse from the vacuum applied at its interior.

Apart from the above noted differences, the operation of an apparatus in accordance with this embodiment is essentially the same as the apparatus in accordance with the embodiment described above.